BAIRD 'VARSITY' TAPE RECORDER MODEL 101

CIRCUIT DESCRIPTION

General

A hybrid circuit is employed, using a transistor input stage (OC44) for low noise, microphony and hum, followed by a valve amplifier (ECL86) to provide voltage gain and power output. A separate valve (EL84) is used as a bias oscillator during recording, enabling the output stage of the audio amplifier to be used for monitoring. An Electron-beam indicator (EM87) is used as a recording level indicator, and the triode section of this valve is used during recording to provide additional gain and frequency correction.

Recording

Two input sockets are provided; one for microphone, having a sensitivity of approximately 1mV. and the second for higher level inputs of the order of 200 mV. The inputs are independently controlled by VR1 and VR2 respectively and may be mixed as required.

The audio voltage is applied to the base of the transistor amplifier stage TR1 through C5, base bias being provided by R9, R1 and R2. The output from the transistor is directly coupled to the grid of the triode section of V1a (ECL86). Direct coupling of the two stages and the dependence of TR1 base bias on the cathode voltage of V1 provides stabilisation of the transistor stage.

Audio output from the anode of triode V1a is fed via coupling capacitor C12 to the volume control and also to the negative feedback circuit R8, C2, R7, C1 and R6 providing a fixed amount of bass and treble boost. Volume control VR3 is tapped, and the network C6 and R34 to chassis from the tap provides bass boost as the volume level is decreased.

Audio voltage from the slider of VR3 is fed to switch a3, a section of the record/playswitch, and through this (in the record mode) to the grid of the triode section of the record level indicator (V2–EM87). Audio output from the same point is also made available through potential divider R33 and R32 on an output socket. Output from the anode of V2 triode is fed back to the grid by the bridged – T circuit R11, R12, R13, C9, C10 and C11 which provides sharp feedback rejection at 6.5kc/s. The amplifier stage thus gives a high degree of boost at 6.5kc/s to compensate for subsequent tape and head high frequency losses. The audio output from V2 triode anode is fed to the recording head through C20 and the network R17, R18, C19 which together provide constant-current feed at low and medium frequencies and an increasing current feed in the medium to high frequency range. The audio output from V2 is also fed via R16 to diode D1 (OA81) where it is rectified and applied as bias to the triode grid of V2 through R15, so controlling the fluorescent display of V2 and giving an indication of recording level. Since V2 triode is also used for amplification a degree of volume compression during recording is provided.

Sections a4 and a5 of the record/playback switch are used to change the function of the output stage V1b so that it operates as monitor amplifier with separate volume control during recording. Audio output voltage from V2 is fed through C20 and the bass tone control circuit R20, C22, VR4, R21, C21 to potentiometer VR5. Switch a5 connects the grid of V1b to the slider of VR5 which then acts as monitor volume control in addition, both C23 and C24 are in circuit to provide negative feedback treble-cut, so removing from the monitor loudspeaker the recording pre-emphasis applied earlier in the circuit.

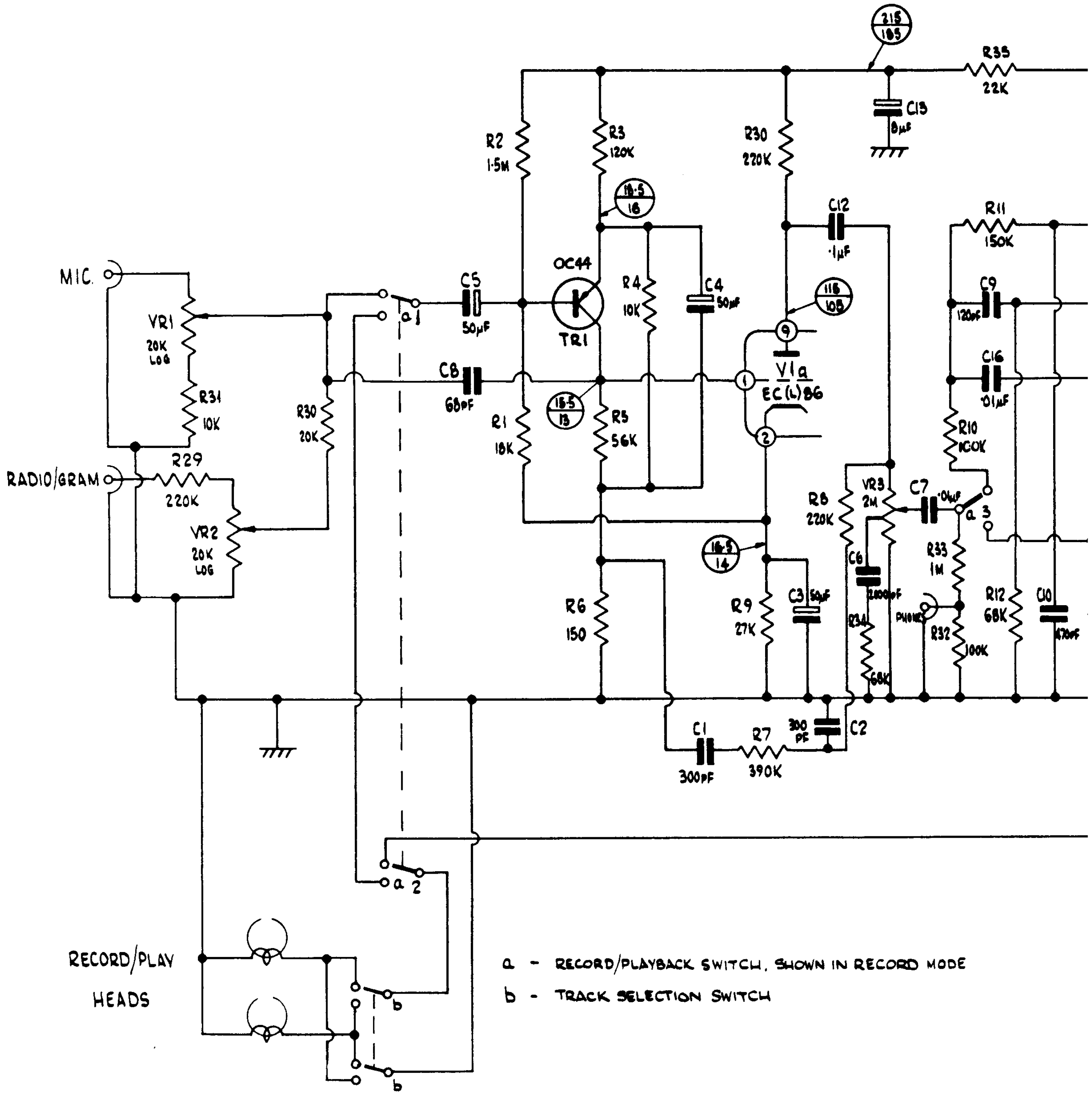
Audio output from V1b is transformer-fed to the loudspeaker. An audio output socket is provided at this point, and insertion of the plug disconnects the internal loudspeaker.

Recording Bias Oscillator

Valve V3 (EL84) functions as an oscillator at 50kc/s during recording, feeding bias voltage from the anode via C27 to the recording head, and feeding the erase head from a secondary winding on the oscillator coil T3.

Frequency of the oscillator circuit is determined mainly by the primary inductance of T3 and the shunt capacitance C29. Since the H.T. feed to the anode is injected into a tap on the primary winding the A.C. voltages at each end of the winding are out of phase at resonance, hence oscillation is sustained by feeding out-of-phase voltage to V3 grid via C28 and R27. Grid current flowing through R26 provides bias for the valve.

During playback the oscillator is switched off by removing the screen voltage from V3 by means of switch a6. Capacitor C26 has a large value so that the oscillation collapses slowly, as abrupt removal of bias voltage from the recording and erase heads might result in head magnetisation.

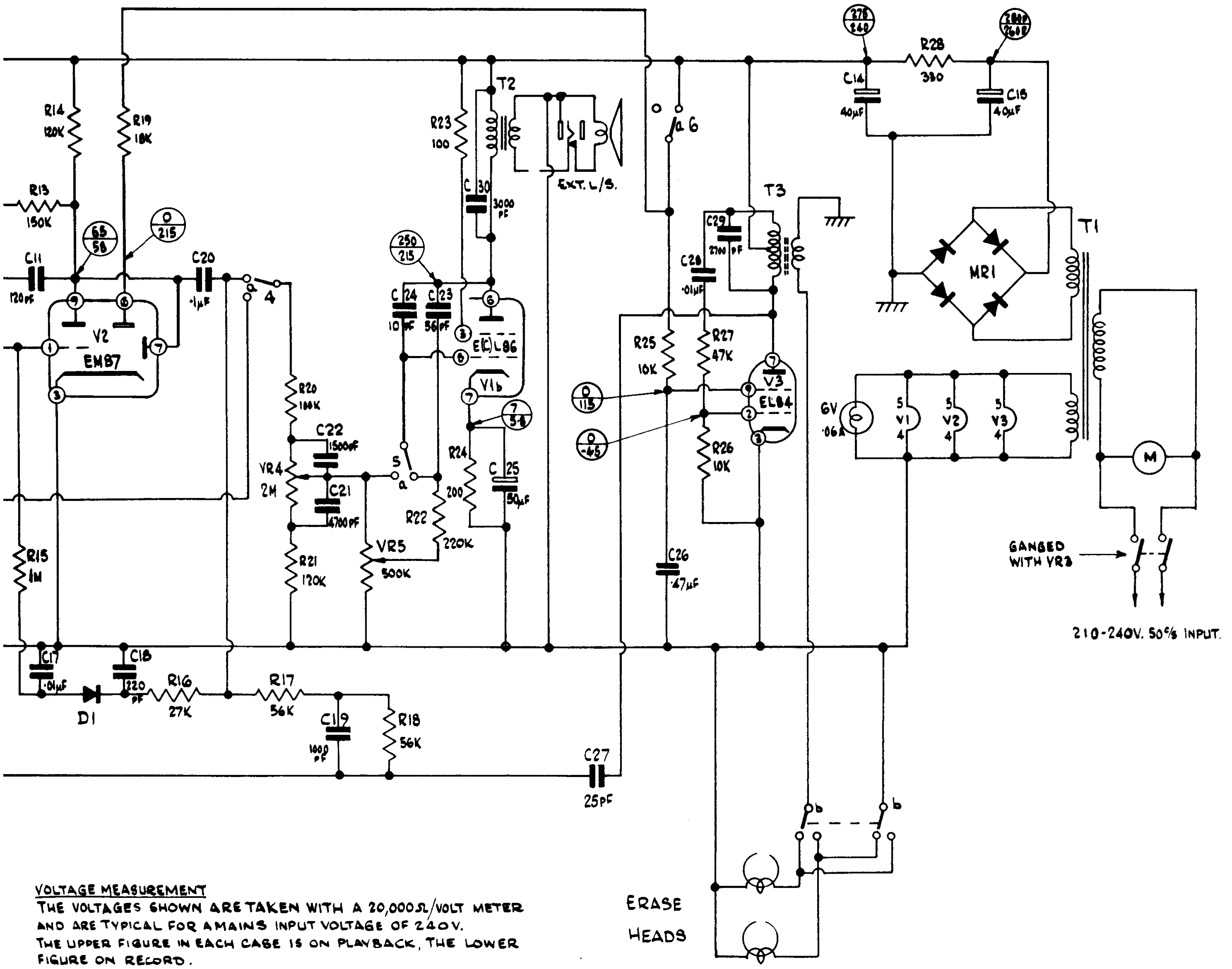


Switch a6 also controls the target anode voltage of V2 (EM87), the record level indicator, so that the fluorescence provides visual warning that the tape recorder is in the record mode.

Track Selection

Four track operation is used, two in-line heads allowing the use of tracks 1 or 3 on the first pass of the tape and tracks 4 or 2 when the tape is reversed. Head selection is by means of push button switch (b) and the latching mechanism allows two tracks to be mixed when required for superimposition.

In normal use, the head not selected is shorted out by the switch to avoid cross-talk.



VOLTAGE MEASUREMENT
THE VOLTAGES SHOWN ARE TAKEN WITH A 20,000Ω/VOLT METER AND ARE TYPICAL FOR A MAINS INPUT VOLTAGE OF 240V.
THE UPPER FIGURE IN EACH CASE IS ON PLAYBACK, THE LOWER FIGURE ON RECORD.
VOLTAGES SHOWN ARE POSITIVE WITH RESPECT TO CHASSIS UNLESS OTHERWISE STATED.

Playback

The microphone and radio/gram. sockets are disconnected from the amplifier input by switch a1 and signal from the tape head is connected by switches a1 and a2. Signal level at this point from a normally-recorded tape is of the order of 1mV.

After amplification in TR1 and V1a, the audio voltage appearing at the slider of volume control VR3 is fed via switches a3 and a4 to the bass tone control network R20, C22, VR4, R21, C21 and thence to the grid of the output valve V1b (ECL86 pentode). On playback, control VR5 functions as treble tone control, high frequency negative feedback from anode to grid being obtained by C23 and R22 and the degree of feedback controlled by VR5. Fixed high frequency compensation is provided on the output stage by C24.

Audio output from V1b is transformer-fed to the loudspeaker. An audio output socket is provided at this point, and insertion of the plug disconnects the internal loudspeaker.

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SPECIFICATION

Mains Supply: 210–250 volts A.C. 50c/s.

Mains Consumption: 80 watts approx.

Tape Deck: B.S.R. TD10. Capstan tape drive with dynamically balanced flywheel coupled by a jockey pulley to shaded pole motor.

Tape Speeds: 1⅞" per sec., 3¾" per sec., 7½" per sec.

Tracks: 4 on ¼" tape.

Track Selection: By push buttons, allowing track selection during playback.

Super-imposition: Available by recording separately on adjacent tracks and playing both tracks together.

Reel diameter: 7" max.

Fast winding or rewinding time: 2½ mins. approx. for 850' tape.

Tape position indicator: 3 digit numerical, with manual reset.

Record level indicator: Fluorescent indicator with linear display.

Valves: ECL86, EM87, EL84

Transistor: OC44

Diode: OA81

Rectifier: C38 Bridge metal rectifier.

Inputs:
1) Microphone, sensitivity 1 millivolt into 20K ohms impedance.
2) Radio/Gram, sensitivity 200 millivolts into 250K ohms impedance.

Inputs may be mixed by independent level controls.

Outputs:
1) High impedance for external amplifier.
2) Low impedance (3 – 5 ohms) for external speaker with muting of internal speaker.

Tone controls: Independent bass and treble.

Loudspeaker: 8" × 5" elliptical with 10,000 gauss magnet.

Microphone: Magnetic, stick type with stand.

Record/Playback:	1⅞"/sec	3¾"/sec	7½"/sec
Frequency response:	70–4.5 Kc/s ± 3dB	70–8 Kc/s ± 3dB	70–11 Kc/s ± 3dB
Wow and flutter, measured with reference frequency of 3,000 c/s:	.55% RMS	.4% RMS	.3% RMS
Signal/noise ratio, including hum:	30dB	36dB	42dB

Distortion:
High impedance output at 250 mV – 4%
Low impedance output at 1 watt – 5%

Dimensions: 16" × 16½" × 8"

Weight: 24 lbs.

MECHANICAL DETAILS

A removable inspection panel is provided in the bottom of the cabinet. Removal of this panel gives access to the chassis with its valves, printed panel, and associated controls.

To remove the chassis from the cabinet:

1. Pull off the 5 round control knobs.
2. Invert the Tape Recorder and remove the four wood screws to release the inspection panel.
3. Unplug the octal plug which carries leads to the record and erase heads.
4. Disconnect the earth lead which connects the chassis to the tape deck.
5. With the aid of a box spanner remove the four 4BA nuts holding each corner of the chassis control panel to the cabinet top.
6. Disconnect the small coil spring from the lever arm which moves the long slide switch, and move the lever towards the side of the case. This is to prevent the oscillator coil (beneath V3 EL84) from fouling the lever when the chassis is lifted. Keep the coil away from the lever or damage may result. The chassis can now be lifted out of the cabinet.

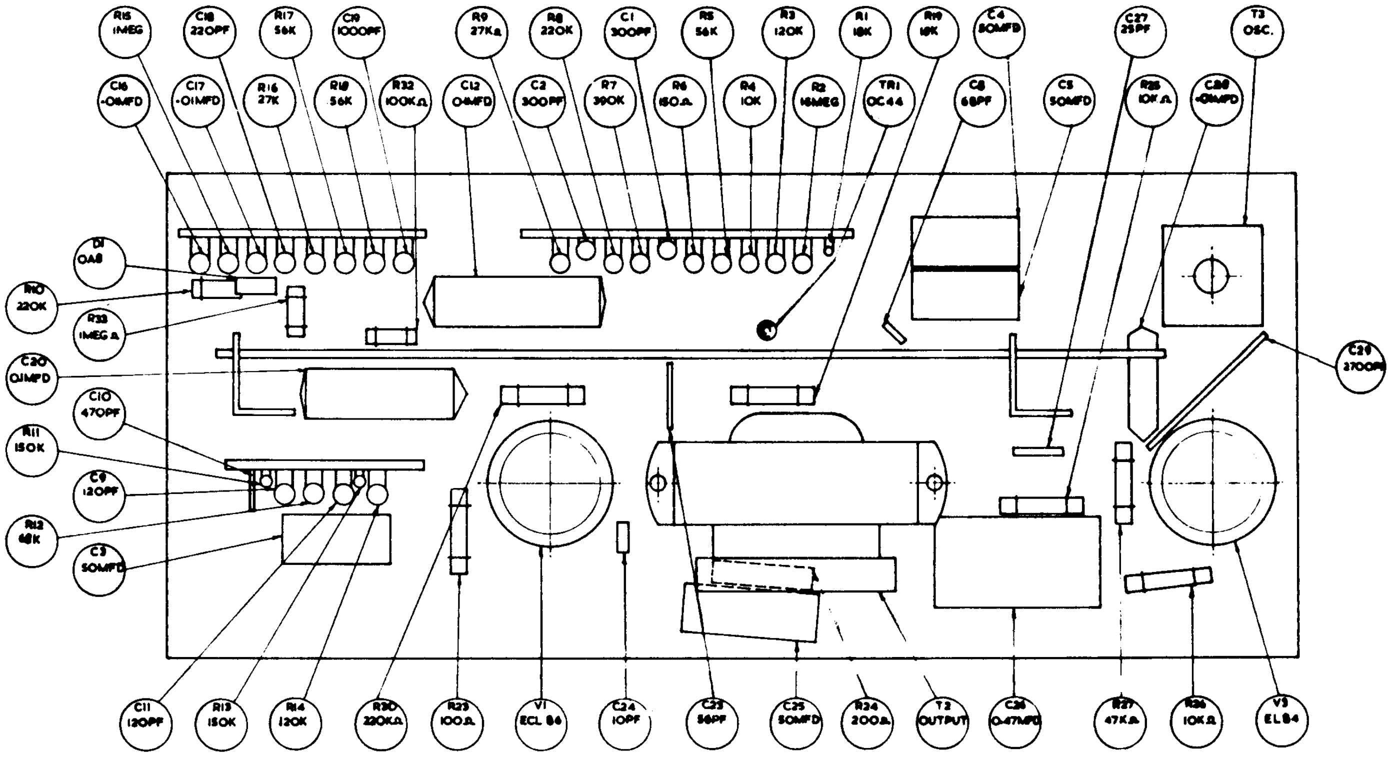
TO REFIT: reverse the above procedure.

To remove the Tape Deck from the cabinet:

Carry out items 2, 3, 4 and 6, shown above.

7. Re-invert the cabinet, taking care that the lever mentioned in item 6 will remain clear of the oscillator coil when the tape deck is lifted upwards, and that the spring is not lost.
8. Unscrew the two long P.K. screws by passing the screwdriver through the 3/8" holes in the top deck plate. Unscrew these until they can be felt to be loose from their 'Spire' fixes.
9. The Tape deck can now be lifted upwards. For complete removal the mains lead to the motor must be disconnected at the control panel end.

TO REFIT: reverse the above procedure.



COMPONENTS LIST

Circuit Ref.	Value	Type	Part No.
	CAPACITORS **10% unless otherwise shown**		
C1	300 pf	Polystyrene	CN 1792
C2	300 pf	Polystyrene	CN 1792
C3	50 mfd	25 V. Elect.	CN 1235
C4	50 mfd	"	CN 1235
C5	50 mfd	"	CN 1235
C6	2000 pf	Polystyrene	CN 1786
C7	2000 pf	Polyester 21	CN 1786
C8	68 pf	P.S.M.	CN 1626
C9	210 pf 2½%	N 750/BP	CN 1794
C10	470 pf 2½%	Polystyrene	CN 1793
C11	120 pf 2%	N 750/BP	CN 1794
C12	0.1 mfd	400V. Polyester	CN 1788
C13	8 mfd	350V. TCC	CN 1076
C14	40 mfd	" "	CN 1076
C15	40 mfd	" "	CN 1076
C16	.01 mfd	25%	CN 4796
C17	.01 mfd	25%	CN 4796
C18	220 pf	20%	CN 1795
C19	1000 pf	20%	CN 1796
C20	0.1 mfd	400V. Polyester	CN 1788
C21	4700 pf	Polystyrene	CN 1789
C22	1500 pf	"	CN 1790
C23	56 pf	P.S.M.	CN 1627
C24	10 pf	Ceramic Tub.	CN 1628
C25	50 mfd	15V. Elect. (For Service Replacement use)	CN 1235
C26	0.47 mfd	400V. Polyester	CN 4910
C27	25 pf	N 750	CN 1797
C28	.01 mfd	Polyester 21	CN 1787
C29	2700 pf	P.S.M. 3220	CN 1629
C30	3000 pf	K 3000/5B	CN 1791
	RESISTORS **10% unless otherwise shown**		
R1	18K	EM2 ¼ watt	RE 4988
R2	1.5 M	8AP "	RHS1155
R3	120 K	" "	RHS1124
R4	10 K	" "	RHS1103
R5	56 K	" "	RHS1563
R6	150 ohms	" "	RHS1151
R7	390 K	" "	RHS1394
R8	220 K	" "	RHS1224
R9	27 K	" "	RHS1273
R10	100 K	" "	RHS1104
R11	150 K 2%	EM2 "	RE 4989
R12	68 K 5%	8AP "	RHG1683

Circuit Ref.	Value	Type	Part No.
R13	150 K 2%	EM2 ¼ watt	RE 4989
R14	120K	8AP "	RHS1124
R15	1 M	" "	RHS1105
R16	27 K	" "	RHS1273
R17	56 K	" "	RHS1563
R18	56 K	" "	RHS1563
R19	18 K	" "	RHS1183
R20	100 K	16 "	RHS7104
R21	120 K	" "	RHS7124
R22	220 K	" "	RHS7224
R23	100 K	8AP "	RHS7224
R24	200 K	8 ½ watt	RBS4201
R25	10 K	8AP ¼ watt	RHS1103
R26	10 K	" "	RHS1103
R27	47 K	" "	RHS1473
R28	330 ohms	10AD 1 watt	RCS6331
R29	220 K	16 ¼ watt	RHS7224
R30	220 K	" "	RHS7224
R31	10 K	" "	RHS7103
R32	100 K	" "	RHS7104
R33	1 M	9AP2 1/5 watt	RE 4912
R34	68 K	16 ¼ watt	RHS7683
R35	22 K	" "	RHS7223
		POTENTIOMETERS	
VR1	20 K Log	Mic. Level	VR 1072
VR2	20 K Log	R/G Level	VR 1072
VR3	2 M Lin.	Vol. on/off	VR 1071
VR4	2 M Log	Bass	VR 1070
VR5	500 K Log	Treble. Monitor Vol	VR 1069
		MISCELLANEOUS	
Loudspeaker		8" × 5" 10,000 line	LS 1073
T1		Mains Transformer	TR 1217
T2		Sound O/P Trans.	TR 1439
T3		Oscillator Trans.	CL 1419
S 1		Slider Switch	SW 1424
MR1		Rectifier	GR 4322
D1		Diode OA81	GR 4011
		KNOBS	
Stop - rewind (on deck)			KN 1113
Record - Playback (on deck)			KN 1114
Small control (on panel)			KN 1108
Large Control (on panel)			KN 1115